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| **Lesson Title: CSI and the albino koala bear** |
| **Subject area: Science Fourth Grade** |
| **Introduction:** DNA fingerprinting is a fairly new technique used for identification in many species, particularly in humans in forensics. It can be used for paternity testing as well. This analysis uses DNA from a tiny amount of tissue such as skin, blood, or hair follicles. Certain sections of the DNA are copied using enzymes. The sections are specific and have variable numbers of repeats in the DNA. For example, one allele from the mother might have 4 copies, while the other allele from the dad might have 2 copies of the repeat. The copied sections are sized using electrophoresis, which is a type of chromatography. The mixed sample is separated so that smaller DNA pieces migrate faster than bigger pieces. The resulting patterns can be observed and compared. The potential fathers, the mother, and the baby’s DNA is analyzed. Using logic and reasoning, the identity of the father can be determined since mom contributes half of the alleles, dad must contribute the remaining half. For human forensics 17 different DNA sections are used. |
| **Lesson Length:** 30-40 minutes |
| **Materials:** counters, index cards, handouts, Brain Pop “DNA”, news report <http://news.bbc.co.uk/2/hi/americas/107247.stm> ELMO, Projector |
| **Lesson Overview:**  This lesson uses genetic and physical science analogies to generate data that is used to identify the father of an albino koala bear. The lesson targets new technology using a real-world scenario that is based in genetics and biotechnology. |
| **Tennessee Standards:**  **SPI 0407.Inq.**1 Select an investigation that could be used to answer a specific question.  **GLE 0407.T/E.1** Describe how tools, technology, and inventions help to answer questions and solve problems |
| **Lesson objective(s):**  Students will recognize that offspring gets genetic information from both parents.  Students will learn how new technology can be used for identification purposes  Students will design an investigation to find the koala’s father. |
| **ENGAGEMENT**   * Describe how the teacher will capture students’ interest.   Put up a picture of the albino koala bear on the board/screen. Ask for observations… eventually they will say he is ‘white.’ This is a condition called albinism. It is important to know which of two koalas his dad is. He would not survive in the wild because predators would see him more easily.   * What kind of questions should the students ask themselves after the engagement?   Where have I seen this? [probably TV shows like CSI]  Have I ever seen an albino in person?  Would I be able to get a job doing that? |
| **EXPLORATION**   * Describe what hands-on/minds-on activities students will be doing.   Students will be using a model of DNA fingerprinting technology to observe patterns and use logic to determine the father of an albino koala bear (see p. 5 of lesson plan). Students will write the names of all four koalas on index cards, one koala per card. Using beads or counters (legos will work well too) students will copy the model of the DNA from each koala onto the corresponding index card. Students will then solve for which koala is the father of the baby albino koala.   * List “big idea” conceptual questions the teacher will use to encourage and/or focus students’ exploration |
| **EXPLANATION**   * Student explanations should precede introduction of terms or explanations by the teacher. What questions or techniques will the teacher use to help students connect their exploration to the concept under examination?   This technology requires explanation of nearly all things that will be unknown to the student. Exploration and analysis following the activity, such as posing the questions listed in the bullet below will draw out student exploration.   * List higher order thinking questions which teachers will use to solicit *student* explanations and help them to justify their explanations.   Where else do you think we could use this technology? [CSI-type cases, forensics]  Does your whole body have the same DNA/genes? [yes]  Could you do the same analysis if the mother was in question, but not the father? [yes]  If the entire DNA the koala has came from the mom, how would the analysis have turned out? [all mom’s genes]  If the other koala was the father, how would the baby’s DNA be different? What patterns might you see? |
| **ELABORATION**   * Describe how students will develop a more sophisticated understanding of the concept.   They will be constructing knowledge based on patterns in data and then USING those patterns to make predictions.   * What vocabulary will be introduced and how will it connect to students’ observations?   Allele – a version of a DNA sequence  DNA fingerprinting – using DNA repeats for identification   * How is this knowledge applied in our daily lives?   It is a real world scenario into which they can fuse their foundational knowledge of parentage to new technology and its uses in identification. |
| **EVALUATION**   * How will students demonstrate that they have achieved the lesson objective?   They should be able to construct the patterns and make an accurate prediction. If the instructor changes the “baby’s” gene pattern, they should be able to select the correct prediction.   * This should be embedded throughout the lesson as well as at the end of the lesson   It is important to monitor what the students are doing at each step. |

**Onya-Birri**

**“Ghost-boy”**

A new baby koala bear was born in the San Diego Zoo. He is a rare albino koala. Albinism is an inherited condition. It is important that we know who his parents are. We know his mom is Banjeeri, but we don’t know whether Rory or Jasper is his dad. How can we tell who is his dad?



**•** Just like human babies, koala babies inherit their genes or genetic material from both of their parents.

**•** So Onya-Birri inherited half of his genes from his mom (Banjeeri) and the other half from his dad (Rory or Jasper).

**•** We can tell from whom Onya-Birri received his genes by comparing all of their genes (DNA) at once using DNA fingerprinting.

DNA fingerprinting has four steps:

- first we need to isolate some of each koala’s DNA

(we can get this from blood or skin)

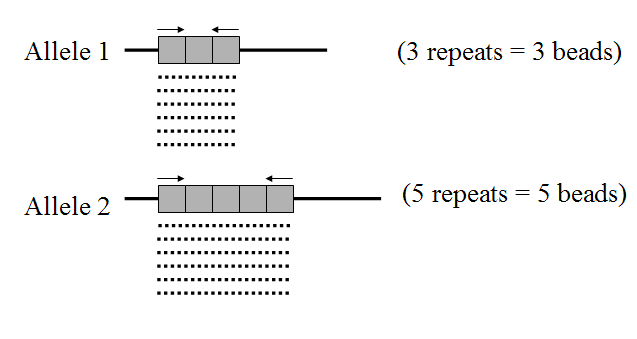
- next we have to find a way to make enough DNA to see

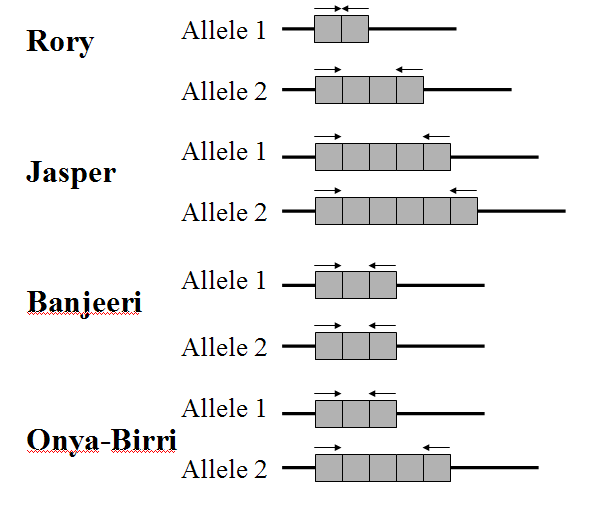
(polymerase chain reaction)

- third we have to separate the DNA by size

(electrophoresis)

- and finally, we look at the DNA patterns.





**Electrophoresis**

Bigger pieces of DNA will travel slowly and stay near the top.

Smaller pieces of DNA will travel fast and be found near the bottom.

DNA

A way to separate the DNA by size by using electricity.

Rory’s

DNA

Jasper’s

DNA

Banjeeri’s

DNA

Onya-Birri’s

DNA

control

DNA

10

8

6

4

2



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is my dad!